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INTERSTATE TRANSFER OF ELECTRIC POWER IN 1929

Statistical Bulletin No. 5

June, 1930

Business
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National Electric Light Association
420 Lexington Avenue
NEW YORK CITY

1st Printing
6-30 5M

Publication No. 065

PRINTED IN THE UNITED STATES OF AMERICA
FEDERAL PRINTING COMPANY
NEW YORK CITY

Interstate Transfer of Power
By Electric Light and Power Companies in the United States

Extent of the Transfer of Electric Power Across State Boundaries in 1929

DURING 1929, the total amount of electricity available for distribution to the consumers of light and power was 91,656,000,000 kw-hr. (exclusive of energy imported from Canada). Of this amount, 80,800,000,000 kw-hr., or 88.2 per cent, was generated and consumed within the same State. The remaining 11.8 per cent of the total for the country (or 10,856,000,000 kw-hr.) was transferred across State lines.

This compares with the total of 6,171,000,000 kw-hr. crossing State lines in 1926 as shown by the Harvard report (which was 8.99 per cent of a total consumption of 68,638,000,000 kw-hr. in that year); and with the total of 8,920,000,000 kw-hr. crossing State lines in 1928 as shown by the N. E. L. A. report (which was 10.7 per cent of a total consumption of 83,147,000,000 kw-hr. in that year).

The net increase in the proportion of interstate power was thus 1.1 per cent in 1929 over 1928 as compared with an average increase of 0.85 per cent for the two previous years.

About three-quarters of this relative increase in proportion of interstate power is accounted for by the fact that the Conowingo, Maryland, hydro-electric plant operated for the full year instead of eight months as in 1928 and by the fact that the State Line, Indiana, steam plant began operations, with the predominant part of its output crossing the boundary into the Chicago area. The remainder of the increase is accounted for by the fact that each year reporting companies have been in a better position to measure and total the kilowatt-hours in each direction; that is, to report the gross transaction and not merely the net transfer of power.

Beyond these two factors the average for the rest of the power transferred across State lines in 1929 shows no appreciable change from the general rate of growth in the use of electric light and power in the United States.

Developments During 1929 *Affecting Interstate Power*

The year 1929 was characterized by abnormal industrial activity requiring unusually large increases in the output of electric power; in some instances taxing the capacity of generating plants. In addition to this, there was a deficiency in water supply in various parts of the country, resulting in curtailed outputs from hydro-electric plants. This threw an additional load upon steam power plants. The result was to increase the percentage in interstate power in some areas and to decrease it in others, and in some instances to cause a reversal in the direction of the flow of power over interconnected systems.

From the standpoint of interstate power, the commencement of operations by the State Line plant at the outskirts of Chicago was the most important development. This station, whose western property line constitutes the Indiana-Illinois boundary, is designed to supply power to the concentrated industrial area at the southern end of Lake Michigan. Pending further development of the power market in the adjacent Indiana territory, the great bulk of its power moves into Illinois, reversing the direction of flow of current which has existed in previous years and causing a large increase in the amount of interstate power between these two States.

In transmission lines, two additional important ties affecting the interstate movement of power were completed in the East. One, closing the gap between the Newark generating area and Philadelphia, marks further progress in the Conowingo power pool. The other, between Scranton, Pa., and Binghamton, N. Y., establishes interconnection between the anthracite coal region and the waterpowers of New York State. Elsewhere, however, interconnection and the extension of service to new areas was almost entirely confined to intrastate construction.

As was pointed out in our previous report on interstate power (Statistical Bulletin No. 4, October, 1929) some 30 large plants located across State boundaries from the markets for which they were built in whole or in part furnish approximately two-thirds of all the interstate power. In 1928 these 30 plants furnished 66 per cent of the interstate power; in 1929 their number was increased to 31 by the State Line plant already mentioned and their output contributed 63 per cent of the interstate power. There was a curtailed output from the large interstate hydro-electric plants but this was practically offset by the addition of the State Line plant, by the full year's operation of Conowingo, and by the increased output of some of the steam stations. (See Table III on page 4).

In considering individual state percentages of imports and exports of power, the effect of these 31 interstate plants is particularly noticeable. All of the high percentages are the result of the operations of these few plants.

The character of lines crossing state boundaries, as of the close of 1929 and divided by the principal voltage classifications, is shown below. No attempt has been made to count the number of comparatively unimportant distribution lines carrying less than 2,300 volts.

Voltage	*Number of Lines*
11,000 volts, up to 33,000	163
33,000 volts, up to 66,000	161
66,000 volts, up to 110,000	87
110,000 volts, up to 220,000	64
220,000 volts	1
Total high tension	476
2,300 volts, up to 11,000 volts	78
Total crossings	554

The distribution of interstate power by states and by the major geographic divisions of the country is given in tabular form and the changes in the relative magnitude of interstate power transfer since 1926 are indicated.

Table I (on page 2) shows the relationship between imports and the total power available for distribution to consumers in each state and Table II (on page 3) shows it between exports and the total energy generated.

Basis of These Statistics

The statistics herein contained were determined from reports received by the Statistical Research Department of the National Electric Light Association from reporting member companies that were engaged in the interstate transfer of electric power during 1929. These reported transactions embraced 95 per cent of the total power transferred across State lines. The balance, representing approximately fifty transactions comprising the remaining 5 per cent, were estimated from the best available data to indicate the magnitude of each transaction.

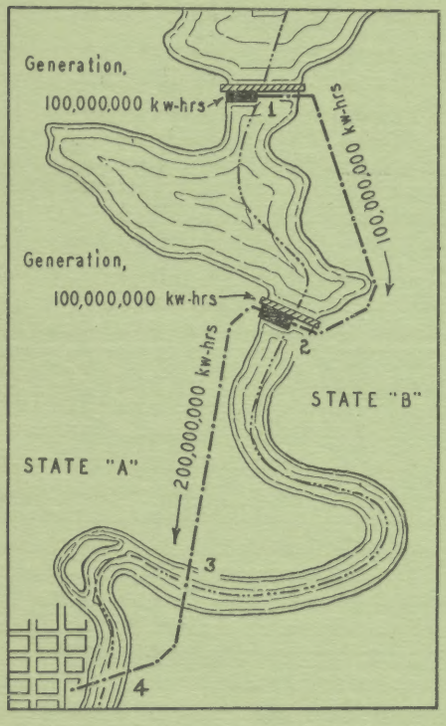
The figures embrace the operations

of enterprises primarily devoted to the generation and distribution of electricity. They do not include electric power entering into interstate transmission as generated by railroads, street railway systems, industrial enterprises not public utilities, and the United States Reclamation Service.

Duplications in Interstate Power Figures

The accurate evaluation of the total interstate power is not simple because in a number of instances State boundary lines are crossed two or more times by the same transmission line and, if the amount of transfer at each individual crossing is added to the grand total, there results a very considerable duplication. If a consignment of shoes from a factory in Massachusetts is shipped to a warehouse in Minneapolis, it may cross eleven State lines and could thus be counted eleven times, though it actually constitutes but one interstate shipment. So, in the case of a number of the interstate power transactions, the same power crosses an interstate boundary two, three or four or, as in one case, even six times in reaching its point of final consumption.

In preparing these statistics on interstate power, an effort has been made to eliminate such duplication, although it



Actually, no interstate power transaction takes place here, because all the electricity is sold in the same state in which it is generated. However, 100,000,000 kw-hrs. pass from State "A" to State "B" at crossing No. 1 and back again at crossing No. 2. Furthermore, 200,000,000 kw-hrs. pass out of State "A" again at crossing No. 3 and return once more at crossing No. 4. Counting each individual passage across a state line, it is possible to make 600,000,000 kw-hrs. of interstate power out of an original generation of only 200,000,000.

TABLE I

INTERSTATE TRANSFER OF ELECTRICITY—1929

	Total Consumption of Electricity* (Million Kwh.)	Interstate Power: Imported Into State (Million Kwh.)	Interstate Power: Per Cent of Consumption	Per Cent of Consumption 1928†	Per Cent of Consumption 1926††
Total U. S. A.**	91,656	10,856	11.84	10.73	8.99
New England	*6,127*	*844*	*14.4*	*14.5*	*14.8*
Maine	673	1	0.2	0.1	0.2
New Hampshire	285	17	6.0	3.9	28.1
Vermont	187	20	10.7	11.3	12.8
Massachusetts	3,017	586	19.4	18.8	18.1
Rhode Island	614	159	25.9	25.0	28.1
Connecticut	1,351	101	7.5	9.5	5.2
*Middle Atlantic***	*24,927*	*3,107*	*12.4*	*9.7*	*5.9*
New York**	11,610	66	0.6	0.5	0.2
New Jersey	2,633	501	19.0	12.0	10.9
Pennsylvania	9,030	2,078	23.0	17.6	6.8
Delaware	145	96	66.2	32.0	9.6
Maryland (Including Dist. Col.)	1,509	366	24.2	41.8	46.4
East North Central	*22,434*	*1,714*	*7.6*	*6.5*	*6.8*
Ohio	6,459	550	8.5	10.1	10.7
Indiana	2,164	227	10.5	11.9	8.9
Illinois	7,338	665	9.1	4.5	5.8
Michigan	4,423	97	2.2	2.0	1.3
Wisconsin	2,050	175	8.5	7.0	7.7
West North Central	*6,052*	*1,517*	*25.1*	*27.8*	*26.6*
Minnesota	1,334	346	25.9	31.5	18.9
Iowa	945	49	5.2	6.0	9.9
Missouri	2,239	1,064	47.5	51.6	56.0
North Dakota	98	7	7.1	8.9	10.7
South Dakota	110	10	9.1	8.9	4.3
Nebraska	464	2	0.4	0.3	0.3
Kansas	862	39	4.5	5.1	5.1
South Atlantic	*7,377*	*1,473*	*20.0*	*19.6*	*15.5*
Virginia	1,157	138	11.9	7.3	10.6
West Virginia	1,438	455	31.6	23.7	9.1
North Carolina	1,708	467	27.3	32.7	23.2
South Carolina	1,026	16	1.6	0.6	8.8
Georgia	1,384	376	27.2	28.5	30.4
Florida	664	21	3.2	2.9	0.2
East South Central	*3,711*	*641*	*17.3*	*15.3*	*9.0*
Kentucky	812	256	31.5	32.0	32.2
Tennessee	1,130	129	11.4	8.0	1.2
Alabama	1,520	65	4.3	4.5	0.6
Mississippi	249	191	76.7	73.6	47.9
West South Central	*4,894*	*526*	*10.8*	*8.6*	*6.3*
Arkansas	423	310	73.3	64.1	27.6
Louisiana	663	61	9.2	6.0	3.4
Oklahoma	1,071	130	12.1	9.1	17.1
Texas	2,737	25	0.9	0.4	0.1
Mountain	*4,104*	*770*	*18.8*	*17.8*	*16.4*
Montana	1,639	23	14.0	0.4	....
Idaho	523	211	40.3	26.7	21.9
Wyoming	73	1	1.4	....	....
Colorado	514	....	....	0.4	....
New Mexico	73	9	12.3	14.5	7.4
Arizona	320	9	2.8	1.4	2.7
Utah	861	457	53.1	64.9	54.7
Nevada	101	60	59.4	43.3	55.4
Pacific	*12,030*	*224*	*1.9*	*1.6*	*1.8*
Washington	2,417	112	4.6	4.2	5.6
Oregon	1,054	52	4.9	4.0	8.7
California	8,559	60	0.7	0.6	....

*Notes:** "Consumption" is here defined as the sum total of electricity available for distribution to all consumers of light, heat and power.
It is derived as follows:
Generated by electric light and power plants.....
Add: Procured from enterprises not public utilities.....
Add: Imported from adjacent States.....
Total .....
Subtract: Exported to adjacent States.....
Balance: 'Consumption" in State.....

**Not including electricity imported from Canada

†N E L A Statistical Bulletin No. 4

††As reported by the Bureau of Business Research of Harvard University

is not practicable to do so entirely. Power generated in one State and moving across a second State to reach its market in a third State has been counted but once, as an interstate transfer between the first and third States. Power produced and consumed in the same State has not been counted as interstate power although in the transmission it may have angled across some portion of a second State. Power crossing and recrossing an irregular State boundary line has been counted once only.

The chart, which shows a hypothetical case, illustrates the extent to which figures for the interstate transfer of electricity can be pyramided according to various definitions or ways of counting.

Not all cases, however, are as clean-cut as that shown on the chart. In some instances power generated in one State intermingles with local generation in a second State and then a part of this combined power is transferred to a third State or may be returned to the first State for final consumption. Unlike the consignment of shoes, previously cited, which can be identified in its travel at every stage from the point of origin to the point of consumption, it is impossible to tag a kilowatt-hour and follow it through to its ultimate consumer. In situations of this character, no attempt has been made to eliminate duplications in interstate power transfers except in two or three instances where the contribution by the local generating plant in the second State was relatively minor.

After eliminating those duplications which could be identified, it is estimated that the total of kilowatt-hours of interstate power shown in this report still contains five per cent of duplications.

If no attempt were made to eliminate any duplications whatever, it is estimated that the interstate transfers of power by the light and power industry would amount to 15 per cent of the total power generated, instead of 11.8 per cent as shown in this report.

In this report the imports of electricity into a particular State are compared with the total amount of energy consumed in that State. This figure of consumption is arrived at by adding together the power generated by light and power enterprises, the power purchased by them from factories and other similar sources and the power imported by them from neighboring States, and by subtracting the power exported to adjacent States. The result is the net amount of energy available for distribution to the consumers in that State.

This definition of consumption includes transmission and distribution losses in serving the consumers and differs by the amount of such losses from the actual "sales to ultimate consumers." Inasmuch as transmission and distribution losses are all intrastate and are a necessary part of the consumption of electrical energy, this basis of comparison is more logical than a comparison based upon sales to ultimate consumers. If the latter base were used, obviously the imported power plus the local supply would equal more than 100 per cent of the sales to ultimate consumers, the average amount of such excess being 23.5 per cent.

TABLE II
EXPORTS OF INTERSTATE POWER BY
ELECTRIC LIGHT & POWER COMPANIES—UNITED STATES, 1929

	Power Generated (Millions Kwh.)	Power Exported (Millions Kwh.)	Exported Power is Per Cent of Generation	Ditto 1928†	Ditto 1926††
Total United States	91,656	10,856	11.84	10.90	9.06
New England	*6,081*	*839*	*13.8*	*13.1*	*13.8*
Maine	673	1	....	....	0.6
New Hampshire	321	53	16.5	25.8	6.0
Vermont	472	305	64.6	71.9	92.0
Massachusetts	2,685	254	10.6	10.9	10.8
Rhode Island	655	200	30.5	2.1	19.6
Connecticut	1,275	26	2.0	2.7	5.8
Middle Atlantic	*24,443*	*2,623*	*10.7*	*9.1*	*4.8*
New York	11,686	143	1.2	1.8	1.6
New Jersey	2,149	16	0.8	1.4	1.2
Pennsylvania	8,071	1,119	13.9	11.2	8.5
Delaware	53	4	7.6	14.7	17.7
Maryland & D. C.	2,484	1,341	54.0	49.5	12.9
East North Central	*22,998*	*2,278*	*9.9*	*8.4*	*8.1*
Ohio	6,409	500	7.8	6.6	6.2
Indiana	2,462	525	21.3	7.7	10.7
Illinois	7,391	718	9.7	10.5	11.0
Michigan	4,439	113	2.6	1.5	1.8
Wisconsin	2,297	422	18.4	21.0	12.7
West North Central	*5,455*	*920*	*16.8*	*19.9*	*21.6*
Minnesota	1,056	68	6.4	7.3	6.0
Iowa	1,462	566	38.7	45.1	48.3
Missouri	1,220	45	3.7	4.0	6.2
North Dakota	105	14	13.3	15.3	....
South Dakota	108	8	7.4	2.9	9.7
Nebraska	504	42	8.3	9.3	5.5
Kansas	1,000	177	17.7	15.4	17.1
South Atlantic	*8,034*	*2,131*	*26.5*	*25.4*	*19.5*
Virginia	1,310	292	22.3	19.0	1.2
West Virginia	2,135	1,152	54.0	46.2	43.8
North Carolina	1,302	61	4.7	2.1	2.2
South Carolina	1,478	468	32.3	40.9	31.2
Georgia	1,142	134	11.7	8.6	9.6
Florida	667	24	3.6	3.0	....
East South Central	*3,610*	*540*	*15.0*	*15.3*	*14.4*
Kentucky	663	107	16.1	11.8	16.1
Tennessee	1,025	24	2.3	2.9	2.4
Alabama	1,863	408	21.9	25.0	24.9
Mississippi	59	1	1.7	2.0	0.5
West South Central	*4,896*	*528*	*10.8*	*8.5*	*4.4*
Arkansas	131	18	13.7	14.7	0.5
Louisiana	990	388	39.2	32.1	16.1
Oklahoma	977	36	3.7	1.9	2.7
Texas	2,798	86	3.1	1.9	1.2
Mountain	*3,864*	*529*	*13.7*	*15.7*	*14.8*
Montana	1,620	4	0.3	0.2	1.3
Idaho	825	513	62.2	67.5	63.0
Wyoming	72	....	....	....	....
Colorado	519	5	1.0	1.0	....
New Mexico	67	3	4.5	9.6	4.7
Arizona	312	....	....	....	....
Utah	405	1	0.3	....	....
Nevada	44	3	6.8	5.6	....
Pacific	*12,275*	*468*	*3.8*	*2.6*	*2.5*
Washington	2,548	243	9.5	5.2	4.3
Oregon	1,156	154	13.3	12.4	11.3
California	8,571	71	0.8	0.5	1.0

Notes: †N E L A Statistical Bulletin No. 4.
††As reported by the Bureau of Business Research of Harvard University.

TABLE III

IMPORTANT GENERATING PLANTS—SEPARATED BY STATE LINES FROM THE POWER MARKETS FOR WHICH THEY WERE BUILT IN WHOLE OR IN PART. 1929

Name of Plant	Date of Original Installation	Located in State	Supplies Market of	Per Cent of Total Interstate Power Supplied from Each Group—1929
WATER POWER PLANTS				
Vernon	1909	New Hampshire	Industrial Massachusetts	3.5
Davis Bridge	1924	Vermont		
Bellows Falls	1928	Vermont		
Holtwood	(1st Unit 1910) (Last Unit 1914)	Pennsylvania	Southern Pa. and Baltimore, Md.	3
Conowingo	1928	Maryland	Philadelphia, Pa.	11
Cheat Haven	1926	West Virginia	Pittsburgh, Pa., District	1
Catawba	1904	South Carolina	Industrial Piedmont Region of North Carolina	5
Dearborn	1922			
Fishing Creek	1916			
Rocky Creek	1909			
Wateree	1921			
Keokuk	1906	Iowa	St. Louis, Mo., Industrial Area	5
Jim Falls	1923	Wisconsin	St. Paul-Minneapolis, Minn.	3
Wissota	1923			
St. Croix Falls	1910			
Cove	1917	Idaho	Salt Lake City, Utah	1.5
Grace	1908			
Oneida	1915			
Soda	1924			
American Falls	1927	Idaho	Salt Lake City, Utah	2.5
Bishop Creek Plants	1905	California	Nevada mines at Manhattan, Goldfield, etc.	0.5
Bartlett's Ferry	1926	Alabama	Columbus, Ga.	0.5
Youghiogheny	1927	Maryland	Pennsylvania mines	0.5
Chalk Hill Rapids	1927	Michigan	Wisconsin	0.5
TOTAL WATER POWER				37.5%
STEAM POWER PLANTS				
State Line	1929	Indiana	Chicago Industrial Area	4
Sterlington	1927	Louisiana	Southern Ark. and Western Miss.	3
Montaup	1927	Massachusetts	Rhode Island	1
Lowellville	Before 1905	Ohio	Sharon-Mahoning Valleys, Pa.	1.5
Windsor	1917	West Virginia	Ohio industrial district, Pittsburgh region, Pa.	7
Cahokia	1926	Illinois	St. Louis, Mo.	6
Glen Lyn	1927	Virginia	West Virginia Coal Mines	3
TOTAL STEAM POWER				25.5%
GRAND TOTAL; PROPORTION OF TOTAL INTERSTATE POWER				63 %

SUMMARY

TOTAL INTERSTATE POWER is to total electric supply—11.8%.

Percentage of TOTAL INTERSTATE POWER contributed by the above thirty-one plants—63%.

Percentage of TOTAL ELECTRIC SUPPLY contributed by these plants—7.5%.